any other species of the group, this butterfly differs from all in the much greater restriction of the ochreous colouring on the primaries of the male (which commences beyond the end of the cell), in the entirely different coloration of the under surface, the primaries being saffron-yellow on basal two fifths, very pale creamy yellow on the disk, and with the dark bands golden olive or yellow-brown, the two outer bands on the secondaries near together and arched rather than angulated (as in *T. vesta* as compared with *T. mutans*). From all the species excepting *T. Hanningtoni* it differs in the minute discocellular spot on the primaries. Only the wet-season form is known at present either of *T. Hanningtoni* or of this species.

98. *Teracolus protomedia.*

Pontia protomedia, Klug, Symb. Phys., Ins. pl. viii. figs. 13, 14 (1829).

Ranges from the Albert Nyanza northward to Abyssinia and eastward through Somaliland to Arabia.

It is closely related to the preceding species and especially to *T. Hanningtoni*, but its superior size, bright uniform yellow colouring, black-veined primaries, less banded upper surface of secondaries, and lack of a subbasal band on the under surface of these wings, have saved its being regarded as a variety of *T. vesta*. These differences, though perhaps not greater than exist between *T. amelia* and *T. mutans*, are more readily grasped without effort.

The seasonal differences are well defined, the wet-season phase having the chief markings below smoky brown, partly veined with saffron-yellow; the intermediate form has these markings redder and with well-defined veining; the dry phase has them almost wholly bright reddish orange. At Aden all three types occur together as mere variations.

LIX.—*On the Tetrameric Regeneration of the Tarsus in* Phasmidæ. By Edmond Bordage *.

At the meeting held on January 25 last I had the honour to communicate to the Académie des Sciences a few of the principal results that I had obtained previously with reference to the phenomena of autotomy in Phasmidæ †. In conclusion I spoke of the process of regeneration of the ampu-

* From the 'Comptes Rendus,' t. cxxiv. no. 26 (June 28, 1897), pp. 1536–1538: from a separate impression communicated by the Author.

† *Vide suprà*, pp. 473, 476.

tated limbs in the larvæ and nymphs, and I stated that *very frequently* the regenerated limbs exhibited only four joints in their tarsi.

I should say that at that time I had been able to make but a limited number of experiments, and that I did not imagine that I had to deal with a general rule. Since then I have multiplied my observations, and I have clearly proved that the expression "*very frequently*" ought to be replaced by *always*. I must also make mention of the curious circumstance that, in the first place, was especially instrumental in causing me to doubt the generality of this rule.

In the collections of the Natural History Museum of the Island of Réunion (an establishment of which I am director) I had noticed a female *Monandroptera* of which the second pair of legs appeared themselves to be of equal length, although relatively shorter than the others. Moreover, the tarsus of one of them possessed five joints, while that of the other exhibited only four. My first idea was that in the case of these two limbs regeneration had taken place after autotomy. This seemed then to imply that this regeneration produced sometimes five tarsal joints and sometimes four.

But measurements taken with the greatest care enabled me to ascertain that the limb with the pentamerous tarsus was of perfectly normal length, though it was owing to the length that, at the outset, I had been led to doubt the position given to the second pair of legs by the person by whom the insect had been set. While the anterior legs were stretched straight out in the direction of the axis of the body and the posterior ones were extended at right angles thereto, those of the second pair, quite doubled up, took the form of a V reversed; and it was just this shortening that had made me believe that the dimensions were smaller. If the limb with the pentamerous tarsus was of normal length, that with the tetramerous tarsus, which seemed to be equal to it, was nevertheless shorter by nearly 4 millim. I was therefore led to conclude that the latter was the only one that formerly had undergone autotomy.

To explain so trifling a difference in the length of the two limbs and the absolutely similar coloration that they exhibited one had necessarily to suppose that spontaneous amputation had taken place when the insect was still but a larva scarcely emerged from the egg.

In order to assure myself of the fact I collected a certain number of eggs of *Monandroptera inuncans* and watched them hatch. At birth the larvæ measure about 1 centim. in length by 1 millim. in breadth. Their colour is a pale yellow,

with rust-coloured bands forming equidistant rings round the body and legs. The latter have a mean length of 8 millim. One would therefore at first be tempted to suppose that the smallest difference in length between two limbs of the same pair—the one normal, the other regenerated after autotomy—could not be less than this number of millimetres. Under these conditions how are we to suppose that a limb has been regenerated after autotomy, because its length is less by scarcely 3 or 4 millimetres than that of the corresponding limb? I succeeded nevertheless in assuring myself by experiment that the thing was possible. In order to do this I provoked autotomy in a larva which had just hatched. The amputated leg measured 8 millim. and was of precisely the same length as the limb opposite to it. *A priori* one might therefore suppose that the regenerated limb would always be shorter by at least 8 millim. than the one which had remained intact. However, immediately after the first moult, when the larva had just quitted its skin, I perceived the regenerated limb forming a little spiral, which unrolled itself after a few days and assumed the appearance of the other legs. The length of this regenerated limb was between 7 and 8 millim., so that the limb opposite to it, having increased by only 3 millim. and then having a length of 11 millim., the difference between the two legs was little more than 3 millim. There is therefore a difference between the rate of growth of the normal limb and the rate of growth of the limb in course of regeneration, this latter growing more rapidly. This phenomenon certainly affords the interpretation of the doubtful case that I mentioned at the beginning of this communication.

The question may arise whether the variation in the number of the joints of the tarsus is always a consequence of amputation by autotomy or whether it is sometimes congenital. Although hitherto I have never seen tetramerous tarsi in larvæ of Phasmidæ examined immediately after birth, *tetramery* might nevertheless very well be observed in the young on emerging from the egg, and consequently without having been preceded by the slightest mutilation.

So far from regarding autotomy as a *relatively* recent improvement, I should, on the contrary, be disposed to believe that in primary ages certain groups of insects already benefited by the advantages of this protective process. If, indeed, we examine carefully certain of the drawings given by M. Ch. Brongniart in his handsome memoir on primary insects ('Recherches pour servir à l'histoire des Insectes fossiles des temps primaires,' 1893), and especially the figures of pl. xlix. and fig. 1 of pl. xxxvii., we notice in the limbs an arrange-

ment of the coxa, trochanter, and femur strongly suggestive of that pointed out by me in the case of the Phasmidæ in my communication to the Académie des Sciences of February 15, 1897 *. I was particularly struck with this on examining the last figure referred to, which, however, represents an insect much more nearly allied to the Neuroptera than to the Orthoptera, since M. Ch. Brongniart has assigned it to the former.

Messrs. Bateson and Brindley, after mentioning numerous instances of *tetramery* in Blattidæ, conclude that they are to be regarded as cases of *abrupt variation* ("*variation brusque*"), explaining up to a certain point how a species with tetramerous tarsi might be derived, abruptly so to speak, from a species with pentamerous tarsi ('Materials for the Study of Variation,' 1894, pp. 63 and 415–421). A philosophical explanation appears to me much more logical: this consists in regarding, on the contrary, these interesting facts as cases of *atavism*, of reversion to an ancestral condition similar to that still to be observed in the Locustidæ †.

LX.—*New Insects from Embudo, New Mexico.* By T. D. A. Cockerell, Entomologist of the New Mexico Agricultural Experiment Station.

As we ascend the Rio Grande the fauna and flora gradually change, southern types giving place to others of a boreal or sub-boreal character. The detailed study of the distribution of species up and down the banks of the river presents much to attract the zoologist or botanist, and the briefest investigations are repaid by new and interesting results. The present writer had recently an opportunity of spending a couple of days at Embudo, situated on the Rio Grande in northern New Mexico, about 300 miles north of Mesilla. This locality is in a district never explored by entomologists, and it was to be expected that new forms would be found. These expectations were not disappointed, and descriptions of the novelties are herewith presented.

Apidæ.

At the flowers of *Bigelovia* four species of *Perdita* occurred, three of them in considerable numbers. They were as follows:—

* *Vide suprà*, p. 476: "Phenomena of Autotomy in Phasmidæ belonging to the Genera *Monandroptera* and *Rhaphiderus*."

† *Cf.* A. Giard, 'Comptes Rendus de la Société de Biologie,' 1897, no. 12, p. 315.